

Practice and Exploration of Diversified Teaching Modes in Organic Chemistry

Yanfang Zhu, Yuzhen Zhao, Ruijuan Yao, Wenqi Song, Zemin He

Xijing University, Xi'an, Shaanxi, 710123, China

Abstract: We use a variety of teaching methods, such as problem-based teaching method, analogical teaching method, and transfer teaching method, to conduct a new exploration of organic chemistry classroom teaching, which improves students' self-learning ability and students' creativity.

Keywords: Problem-based teaching method; Transfer teaching method; Diversified teaching method

Fund Project:

The special project of the reform of the evaluation system of the scientific research fund of Xijing University (project number: XJZ22003).

Introduction

Organic chemistry is a very important course. In recent years, China's higher education institutions have carried out large-scale reforms and expanded enrollment, which brings new topics and challenges to the organic chemistry education. At an appropriate time, reforming the educational methods and contents and establishing a scientific education system have a very important role in ensuring the quality of education, improving the level of education, and cultivating students' learning ability.

1. Inductive Teaching Method

The application of inductive teaching method means that students can make relevant inductive reasoning and get a result by themselves under the guidance of teachers, which can help them actively acquire knowledge. The approach helps to improve students' independent thinking of the problem and enlightens students' thinking in the process of discussion and induction. The organic chemistry course has the characteristics of "many organic compounds, many reactions, a wide range of subjects, and complex and difficult mechanism", which is one of the most troublesome problems in teaching. In classroom teaching, the main method is to spoon-feed information to them, which pay attention to reasoning and obtaining certain results, that is, to reasoning step by step from the most basic concepts, reactions and theories. However, the analysis and summary of the problem are relatively weak. Students can only use answers to answer questions, but do not know how to answer questions. In order to solve this problem, we apply the induction method to the teaching plan and blackboard writing, apply it to the summary at the end of each chapter, and let students apply it to their own summary after learning a chapter. The induction method can enhance students' ability to comprehensively organize and summarize.

The examination method of replacing exams with competitions can be adopted to reform the examination method of students' professional courses, which needs to reflect professional skill levels and industry standards. As an important professional basic course, organic chemistry needs to bear the brunt of the reform of course examination methods. Replacing exams with competitions is to replace the traditional mode of determining scores by the examination papers at the end of the semester with professional skills competition, which emphasizes more on examining students' practical abilities and innovative spirit. Project construction requires students in the project team to conduct experiments, collate data and write papers.

2. Guided Teaching Method

Guided teaching method is a student-oriented, teacher-led teaching method. Through guided means, teachers can capture stu-

dents' learning motivation and goals, give full play to students' independent learning potential and consciousness, improve students' ability to analyze and solve problems, and improve students' knowledge acquisition efficiency. In this way, the previous "dull" classroom atmosphere can be changed, the purpose of teacher-student cooperation can be achieved, and the purpose of achieving twice the result with half the effort can be achieved. For example, in discussing the addition process of carbonyl groups, we ask: Why is the addition of carbonyl groups nucleophilic, and why are the aldehydes and ketones, which are also carbonyl groups, showing obvious differences in their nucleophilic and additive properties? Students are encouraged to find knowledge about it, to guide the discussion and help students to analyze the essence and root causes of the problem based on its structure, from the polarity of molecules, electronic effects, and spatial effects. When explaining Optical isomerism, teachers can take the first fully synthesized antibiotic drug, chloramphenicol as an example, require students to determine whether it is a chiral molecule by observing its molecular structure^[1]. After study, it was found that the drug has optical activity, and its optical activity is four optical isomers, and then it was found that only 1 R, 2 R-optical isomers is antibacterial, which is used in clinical practice. Then, the students were asked to answer the following questions: ① What isomers are produced in the chemical synthesis of the drug? ② How can we efficiently segment enantiomers? Discussion begins: In a "guided"-class, teachers can expand the range of knowledge taught and increase students' motivation and autonomy. The organic chemistry competition will be divided into two parts. One Part is the required part, which examines the students' grasp of basic theoretical knowledge. One part is the experimental assessment section, which selects actual compound synthesis cases as the assessment content. Students choose to answer one or two cases based on their own abilities and conduct actual synthesis operations. Teachers can evaluate students' comprehensive ability to apply the knowledge and skills they have learned to practical problems by synthesizing these common products in actual production.

3. Analogical Teaching Method

By using the method of "analogy", students can compare the new knowledge they have learned, discover similarities and differences, and obtain accurate results. This is a great way to help students better grasp new knowledge, help them better grasp new knowledge, and promote self-learning.

For example, after learning the relationship between the structure and properties of olefins, when learning the properties of alkynes, we will instruct the students to analyze the differences between the alkyne structure and the olefin structure, the commonality of which is higher electron density and better flow, and is that they both can produce nucleophilic reactions. On this basis, the essence of alkylation reaction and alkylation reaction is linked, and the stability and other performance of intermediate products in the reaction are compared to find the commonalities and differences between the two, and summarize the rules of their reaction performance. In the teaching, we will conduct in-depth research on the structure of heterocycles and discover that heterocycles and benzene rings are both aromatic. By comparing the electrophilicity between these aromatic heterocycles and benzene rings, it can be seen that there are differences in the properties between these aromatic heterocycles and benzene. Afterwards, the teacher will lead the students to start with the essence of electrophilic substitution reactions to discuss the similarities and activity patterns between these two reactions. Students are encouraged to carry out all-round knowledge training by means of replacing exams with competitions to effectively integrate practical skills with basic theoretical knowledge, which emphasizes the application and practicality of organic chemistry knowledge. The second classroom assessment score should be Increased. The second class of organic chemistry should be developed to actively encourage students to enter scientific research topics, cultivate students' practical ability and scientific research ability. And the results obtained in the second class should be used as the pluses of organic chemistry courses. As the state encourages college students to carry out innovation and entrepreneurship training, every year, a significant number of students actively apply for and obtain approval for the National College Student Innovation and Entrepreneurship Training Program.

4. Transfer Teaching Method

Transfer teaching method refers to in the process of teaching, teachers instruct students to use the knowledge they have learned in changing situations to achieve the purpose of mastering new knowledge. Such a teaching method can improve students' ability to apply what they have learned. By analyzing the data, we can easily come to the conclusion that: Hydroxyl anions and alkoxy anions are not good Leaving Groups, so they must be transformed into groups that are easy to leave, and then they are used to chemically react with nucleophiles, and the reaction mechanism is similar to that of halogenated hydrocarbons. By utilizing the transfer method, students can better understand why many alcohol reactions require the use of acidic catalysts^[2]. At the same time, we also have a good understanding of the properties of chemical reactions between ethanol and phosphorus halides, dichloromethanesulfonate and ethanol dehydration into ethers. If we can better understand this problem, then we can better study other problems in the future, such as the breaking of ester bonds, the opening of epoxides, and so on. For example, the free radical substitution reaction mechanism of alkanes

can be transferred to olefins, and the characteristics of aldehydes, ketones, alcohols, and other substances can be transferred to carbohydrates; The characteristics of amines and carboxylic acids can be converted into the characteristics of amino acids. However, we should also remind: in learning, transfer should be carried out according to the actual situation, not simply, and attention should be paid to the changes in properties caused by different constructions.

5. Discussion Teaching Method

The traditional "indoctrination" education method can only let students passively accept knowledge in the classroom, cannot make full use of students' subjective initiative, and cannot effectively screen, filter and transform knowledge. "Discussion" is an effective way to improve this situation. Under the careful preparation and guidance of teachers, students are stimulated by prior design and organization to put forward their own opinions on a certain problem, and then the problems are finally solved one by one through joint discussion between teachers and students. For example, when studying the relationship between the molecular structure of olefin and its physicochemical properties, students were asked to compare 1-pentene, 2-pentene, 2-methyl-2-butene, and came to the conclusion that their stability was the same as their electrophilic addition reactivity. The analysis and discussion of this seemingly conflicting result will stimulate students' interest in learning, stimulate students' active thinking, enable students to master the way of self-intake of knowledge in the process of learning, and improve students' ability to find, raise and solve problems. The instructor will give grades according to the student's literature research reports, and finally aggregate them into the assessment results of the organic chemistry course. The construction of open organic chemistry question bank enriches the course assessment content for organic chemistry competition. Combined with the modular reform of organic chemistry learning content, the organic chemistry question bank is built. According to the learning content of each module, the topic content must include the actual production problems or the development of organic chemistry.

6. Conclusion

To sum up, organic synthesis is a systematic science with strong laws, strong flexibility, wide application and rapid development, which requires teachers to change the traditional teaching mode, flexibly apply various teaching methods, stimulate students' initiative and enthusiasm for learning in the teaching process, so that learning in a relaxed and pleasant teaching atmosphere can tap students' potential to the maximum extent and improve the teaching quality and comprehensive quality of students.

References:

- [1] Zhang Rui. Exploration of Green Chemistry Embodied in Organic Chemistry Experimental Teaching[J]. China Petroleum and Chemical Standard and Quality, 2023, 43(15): 122-124.
- [2] Jiayuan Wang. Practical Research on Project-based Learning of High School Chemistry Based on STEAM Education Concept[D]. Shenyang Normal University, 2023.
- [3] Zhongyan Li, Lin Yuan, Jianwei Xie et al. Construction and Practice of Organic Chemistry Experiment First-class Course under the Background of New Engineering[J]. Guangdong Chemical Industry, 2022, 49(09): 219-220+224.